

REMARKS

Reconsideration of the application is requested. Applicants have cancelled Claims 1-21 and added new Claims 22-42 to address wording concerns. The remarks below refer to new Claims 22-42. The amendments do not restrict the scope of Applicants' invention.

Election/Restriction

This response affirms the election to traverse Group 2. The election is made without traverse.

Specification

The Office Action objected to the disclosure on the grounds that the ruthenium catalyst graphically depicted in the reaction of Example 4 (page 15 of the specification) did not correspond to the ruthenium catalyst recited in the text of Example 4. In view of the amendments above, the objection is believed overcome. Reconsideration is requested.

Rejections Under 35 USC 112, second paragraph

The Office Action rejected Claims 1-21 under 35 USC 112, second paragraph, on the grounds that the claims contained numerous terms, which allegedly rendered them indefinite. The rejection is unwarranted and should be withdrawn in view of the following comments.

A broad claim, no matter how broad, is not indefinite for purposes of section 112, second paragraph, as long as the boundaries of the claim are capable of being understood. Stated differently, breadth alone is not indefiniteness (See *In re Gardner*, 166 USPQ 138 (CCPA 1970)). Definiteness of claim language must be analyzed, not in a vacuum, but in light of (i) the context of the particular application disclosure, (ii) the teachings of the prior art, and (iii) the claim interpretation that would be given by one possessing the ordinary level of skill in the pertinent art at the time the invention was made (See (MPEP 2173.02, *In re Wiggins*, 179 USPQ 421 (CCPA 1973)). 35 USC 112, second paragraph, essentially requires precision and definiteness of claim language (*In re Borkowski*, 164 USPQ 642 (CCPA 1970)). If the scope of the subject matter embraced by the claim is clear, and if applicant has

not otherwise indicated that he intends that claim to be a different scope, then the claim does particularly point out and distinctly claim the subject matter which the applicant regards as his invention (*In re Borkowski* at 645-646). One of ordinary skill in the art reading new Claims 22-42, in light of the specification, would have understood the scope of the invention encompassed by these claims. New Claims 22-42 meet the requirements of 35 USC 112, second paragraph. Reconsideration is requested.

The Office Action rejected Claims 4, 6, 7 and 14 under 35 USC 112, second paragraph, on the grounds that certain terms lacked a proper antecedent basis. In view of the amendments above, the rejection is believed overcome.

The Office Action rejected Claims 1 and 3-21 under 35 USC 112, second paragraph, on the grounds that the terms "comprise" and "comprising" were open-ended, and as such, rendered the claims indefinite. Applicants disagree. Nonetheless, to expedite prosecution that rejection is believed overcome in view of the amendments above. Reconsideration is requested.

The Office Action rejected Claim 7 under 35 USC 112, second paragraph, on the grounds that R and R¹ were given two different definitions. The rejection appears unwarranted. R and R¹ appear to have been defined only once. Clarification is requested.

The Office Action rejected Claim 7 under 35 USC 112, second paragraph, on the grounds that the language "in any other position in the molecule" rendered the Claim indefinite. In view of the amendment above made to Claim 27, the rejection is believed overcome. Reconsideration is requested.

The Office Action rejected Claim 7 under 35 USC 112, second paragraph, on the grounds that the language "a substituent NRR¹ in the position to a double bond" rendered claim indefinite. In view of the amendments above to Claim 27, which specifies an α substituent, the rejection is believed overcome. Support for this amendment can be found on page 5, lines 15-17 of the specification and was inadvertently omitted in Claim 7. Reconsideration is requested.

Applicants submit that one of ordinary skill in the art, reading the newly-

submitted claims would understand what is meant by such language.

Reconsideration is requested.

The other matters with respect to Claim 7 are believed overcome in view of the amendments above.

The Office Action rejected Claim 9 on the grounds that the claim recited the terms "preferably." The rejection is believed overcome in view of the amendments above. Reconsideration is requested.

The Office Action rejected Claim 13 under 35 USC 112, second paragraph, on the grounds that structure V improperly depicted double bonds. The rejection should be withdrawn. One of ordinary skill in the art would have understood that the term " R^3 to R^7 " includes R^5 to R^7 and would have selected only those groups that can form double bonds. Reconsideration is requested.

With respect to the comments regarding the ionic species of Claim 34, Applicant submit that the claim meets the requirements of 35 USC 112. Reconsideration is requested.

The Office Action rejected Claim 14 under 35 USC 112, second paragraph, on the grounds that terms " R^3 to R^5 " were not defined above. Applicants disagree. These terms have been defined with the language R^3 to R^7 . One of ordinary skill in the art would select those terms that are appropriate. Reconsideration is requested.

The Office Action rejected Claim 16 under 35 USC 112, second paragraph, on the grounds that the phrase "cycloalkyl radical" lacked antecedent basis. In view of the remarks above, reconsideration is requested.

Rejections Under 35 USC 103

The Office Action rejected Claims 1, 3-8, and 12-21 under 35 USC 103 as being unpatentable over Armstrong in view of Olivier et al. *Nonaqueous Room-Temperature Ionic Liquids: A New Class of Solvents for Catalytic Organic Reactions* Chem Ind. 68 (1996) 249-263 (Olivier). The rejection should be withdrawn in view of the remarks below. Armstrong and Olivier, singly or in combination, provide general teachings that lack the necessary guidelines and suggestive details required by 35 USC 103.

It is well-established that to establish a *prima facie* case of obviousness, the USPTO must satisfy all of the following requirements. First, the prior art relied upon, coupled with the knowledge generally available in the art at the time of the invention, must contain some suggestion or incentive that would have motivated the skilled artisan to modify a reference or to combine references. *In re Fine*, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). Second, the proposed modification must have had a reasonable expectation of success, as determined from the vantage point of one of ordinary skill in the art at the time the invention was made. *Amgen v. Chugai Pharmaceutical Co.* 18 USPQ 2d 1016, 1023 (Fed Cir, 1991), *cert. denied* 502 U.S. 856 (1991). Third, the prior art reference or combination of references must teach or suggest all of the limitations of the claims. *In re Wilson*, 165 USPQ 494, 496, (CCPA 1970). The Office Action did not establish a *prima facie* case of obviousness.

Applicants' invention relates to a process that prepares cyclic compounds by subjecting a starting material to metathesis in the presence of a catalyst component of homogeneous catalysts and heterogeneous catalysts selected from the group consisting of transition metal carbenes and transition metal compounds that form transition metal carbenes under the reaction conditions or transition metal salts in combination with an alkylating agent. The starting material is selected from the group consisting of compounds containing at least two functional groups in the form of substituted or unsubstituted alkene or alkyne units. The metathesis is carried out in the presence of ionic liquids. Applicants' invention is based on the surprising discovery that the presence of ionic liquids in the metathesis reaction of starting materials that contain at least two functional groups in the form of substituted or unsubstituted alkene or alkyne units leads to an increased in the operating life of the catalyst (Spec. p. 3, ll. 19-21).

Armstrong presents a broad overview of literature from 1980 to 1987 relating to catalytic ring-closing diene metathesis (RCM) reactions in which the substrates are low-molecular weight non-polymeric organic molecule (Section 1.1.). A few of the references discussed address polymeric systems. On page 383, Armstrong discusses applications of ring-closing metathesis. Section 5.1 addresses the total

synthesis of natural products and "non-natural products." Section 5.2 reports that that there is only one example of ring closing metathesis in a tandem process with other reagents (Scheme 37). Section 5.3 reports efforts in which Ring Closing Metathesis has been applied to the synthesis of rigidified amino acids and small peptides. Such broad, open-ended teachings would not be suggestive of Applicants' invention. Armstrong's general overview of the literature simply does not provide suggestive teachings that would have made one of ordinary skill in the art following Armstrong, modify Armstrong, make or practice Applicants' invention and expect the results Applicants have made.

Olivier does not overcome the deficiencies of Armstrong. Nonetheless, even if one of ordinary skill in the art following the teachings of Armstrong, one of ordinary skill in the art would not have found suggestive teachings. Olivier is a document that generally discusses how some very specific organic-inorganic ionic liquids can be used as a new class of solvents for two-phase catalytic organic reactions. The paper devotes attention to discussing numerous subjects. On pages 252-253, for instance, Olivier discusses olefin dimerization. The paper also discusses hydrogenation of C=C bond, olefin hydroformylation, butadiene dimerization, organochloroaluminates as acidic catalysts, and isobutane-butene alkylation. In a short paragraph on page 253, Olivier discusses olefin metathesis without making any indication that would have led one of ordinary skill in the art to expect that some metathesis processes using ionic liquids are different from other metathesis processes that utilize ionic liquids.

One of ordinary skill in the art following the teachings of Armstrong would not have been motivated to modify Armstrong practice Applicants' invention, and expect the results Applicants' have obtained. The examples provided in the specification evidence the invention. In Example 3, for instance, an example that prepares N-carboxymethyl-3,4,5,6-tetrahydroaniline, Applicants indicate that the "catalyst dissolved in the ionic liquid is available for a further reaction with substrate in hexane" (Spec. p. 14, 18-19). Olivier would not have led one of ordinary skill in the art following the teachings of Armstrong to modify Armstrong, practice Applicants'

process and expect that the presence of ionic liquids in the metathesis reaction of starting materials that contain at least two functional groups in the form of an substituted or unsubstituted alkene or alkyne units leads to an increased in the operating life of the catalyst. The broad, sweeping, discussion of the paper, and the superficial brief treatment of a very specific metathesis reaction lack the necessary guidelines and suggestive details required by 35 USC 103.

It is noteworthy that Applicants explained at page 1, last paragraph of the specification that the use of non-aqueous ionic liquids for metathesis reactions are known (Spec. p. 1, ll. 26+). Applicants explained that these ionic liquids are salts or mixtures of salts that are liquid over a wide temperature range (Spec. p. 1, ll. 26-27). The advantage of ionic liquids is that they are immiscible with aliphatic hydrocarbons (Spec. p. 1, ll. 28-30). On page 2, lines 14+, for instance, Applicants discuss disadvantages of processes that use ionic liquids for the dimerization of unsubstituted olefins. Applicants further explain that known metathesis processes were known suitable only for the reaction of unsubstituted monoolefins, i.e., very simple organic molecules (Spec., p. 2, ll. 19-21). Further, Applicants explain that known metathesis processes are not suitable for the reaction of multiply substituted starting materials bearing functional groups, since the catalysts cannot be employed or the ionic liquids are unsuitable for other catalysts because of their composition or the fact that the reaction mixture has an acidic character (Spec. p. 2., ll 21-25) The broad teachings of Olivier do not add anything that would have motivated one of ordinary skill in the art to modify Armstrong, practice Applicants' invention, and expect the results Applicants have obtained. Reconsideration is requested.

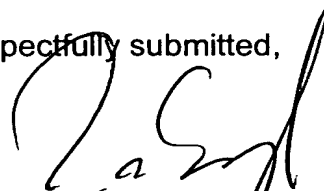
It is well-established that in a sense, virtually all inventions are combinations of old elements (*In re Rouffet*, 47 USPQ2d 1453, 1457 (CAFC 1998)), and that the USPTO may often find every element of a claimed invention in the prior art (*In re Rouffet*, 47 USPQ2d 1457). If identification of each claimed element in the prior art were sufficient to negate patentability, very few patents would ever issue. (*In re Rouffet* at 1457). In view of the amendments and remarks above, Applicants request that the USPTO recognize the teachings of Armstrong and Olivier, singly or

in combination, are vague, ambiguous, and non-suggestive under 35 USC 103, and properly conclude that Applicants' invention encompassed by Claims 22-42 are allowable in their present form.

In view of the remarks above, a Notice of Allowance is earnestly requested.

Respectfully submitted,

By



Diderico van Eyl
Attorney for Applicants
Reg. No. 38,641

Bayer Corporation
100 Bayer Road
Pittsburgh, Pennsylvania 15205-9741
(412) 777-8355
FACSIMILE PHONE NUMBER:
(412) 777-8363
s:\shared\jmf\DVE5451

VERSION TO SHOWING MARKINGS WITH CHANGES MADE

IN THE CLAIMS

Claims 1-21 have been cancelled, and Claims 22-42 have been added:

22. A process for preparing cyclic compounds comprising
subjecting a starting material in the presence of a catalyst component to metathesis
reaction in the presence of an ionic liquid,

wherein the starting material is selected from the group consisting of
compounds containing at least two functional groups in the form of substituted or
unsubstituted alkene or alkyne units; and

wherein the catalyst component includes homogeneous catalysts and
heterogeneous catalysts selected from the group consisting of (i) transition metal
carbenes, (ii) transition metal compounds that form transition metal carbenes under
the reaction conditions, and (iii) transition metal salts in combination with an
alkylating agent.

23. The process of Claim 22, wherein the cyclic compounds are selected
from the group consisting of carbocyclic compounds and heterocyclic compounds
having ring sizes of ≥ 5 ring atoms.

24. The process of Claim 22, wherein the starting material further
comprises at least one substituent that is inert in the metathesis reaction and/or a
heteroatom.

25. The process of Claim 24, wherein the at least one substituent or the
heteroatom is selected from the group consisting of branched or unbranched alkyl
radicals, aromatic or non-aromatic carbocyclic rings, carboxylic acids, esters, ethers,
epoxides, silyl ethers, thioethers, thioacetals, anhydrides, imines, silylenol ethers,
ammonium salts, amides, nitriles, perfluoroalkyl groups, geminal dialkyl groups,
alkynes, alkenes, halogens, alcohols, ketones, aldehydes, carbamates, carbonates,
urethanes, sulphonates, sulphones, sulphonamides, nitro groups, organosilane
units, metal centers and oxygen- containing heterocycles, nitrogen- containing
heterocycles, sulphur- containing heterocycles, and phosphorus-containing
heterocycles.

26. The process of Claim 25, wherein the starting material is a α,ω -diene that optionally contains a member selected from the group containing at least one further substituent that is inert in the metathesis reaction and a heteroatom,

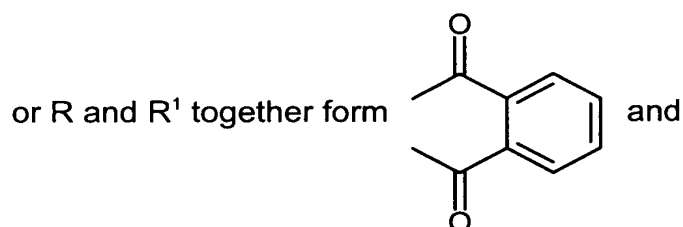
wherein the further substituent or heteroatom is selected from the group consisting of branched alkyl radicals, unbranched alkyl radicals, aromatic carbocyclic rings, non-aromatic carbocyclic rings, carboxylic acids, esters, ethers, epoxides, silyl ethers, thioethers, thioacetals, anhydrides, imines, silylenol ethers, ammonium salts, amides, nitriles, perfluoroalkyl groups, geminal dialkyl groups, alkynes, alkenes, halogens, alcohols, ketones, aldehydes, carbamates, carbonates, urethanes, sulphonates, sulphones, sulphonamides, nitro groups, organosilane units, metal centers and oxygen-containing heterocycles, nitrogen-containing heterocycles, sulphur-containing heterocycles and phosphorus-containing heterocycles.

27. The process of Claim 26, wherein the α,ω -dienes used bear a α substituent NRR^1 in the α position to a double bond, wherein

R is hydrogen or an organic substituent,

R^1 is tert-butyl, $\text{P}(\text{R})_2$, $\text{P}(\text{R}^2)_2$, COR, SO_2PhR , COOR or CONRR^2 ,

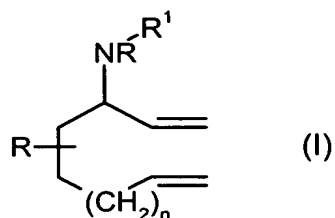
R^2 is alkyl or phenyl,



said α,ω -dienes may also bear at least one further substituent R in any other position with the exception of the α position.

28. The process of Claim 27, wherein R is selected from the group consisting of hydrogen, fused or unfused aryl, alkyl, CN, COOR² or halogen.

29. The process of Claim 27, wherein the α,ω -dienes used have the formula (I)



wherein R, R¹ and R² are as defined in Claim 27 and n is 1, 2, 3 or 4.

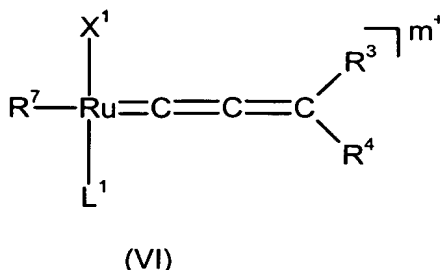
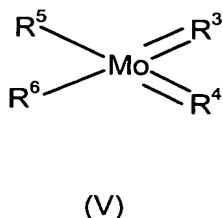
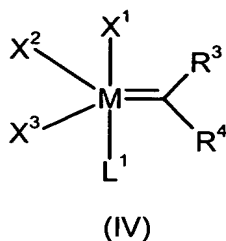
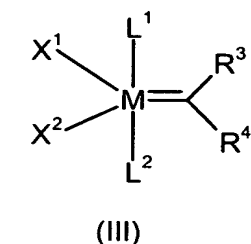
30. The process of Claim 29, wherein n is 1 or 2.

31. The process of Claim 30, wherein n is 1.

32. The process of Claim 27, wherein the α,ω -dienes used are diallylamine or 3-amino-1,7-octadiene, or 1,7-octadiene, 10-undecenoyl-allylamide, 1,4-bis-oxypropen-2-yl-but-2-ine or buten-4-yl 10-undecenoate.

33. The process of Claim 32, wherein the α,ω -dienes used are in N-carboxymethyl-protected form.

34. The process of Claim 32, wherein the catalysts used are compounds of the formulae (III), (IV) (V) and (VI):



wherein M is ruthenium or osmium, and

wherein R³ to R⁷ are radicals selected from the group consisting of hydrogen, C₁-C₂₀-alkyl, C₃-C₈-cycloalkyl, C₂-C₂₀-alkenyl, C₂-C₂₀-alkinyl, C₆-C₁₈-aryl, C₁-C₂₀-carboxylate, C₁-C₂₀-alkoxy, C₂-C₂₀-alkenyloxy, C₂-C₂₀-alkinyloxy, C₆-C₁₈-aryloxy, C₂-C₂₀-alkoxycarbonyl, C₁-C₂₀-alkylthio, C₁-C₂₀-alkylsulphonyl and C₁-C₂₀-alkylsulphinyl, N-aryl; wherein in each case unsubstituted or substituted by C₁-C₉-alkyl, perfluoroalkyl, halogen, C₁-C₅-alkoxy or C₆-C₁₈-aryl; and wherein the radicals R³ to R⁷ may be linked to one another in cyclic compounds,

X¹ to X³ are anionic ligands are selected from the group consisting of F⁻, Cl⁻, Br⁻, CN⁻, SCN⁻, R³O⁻, R³R⁴N⁻, (R³-R⁷)-allyl⁻, (R³-R⁷)-cyclopentadienyl⁻, wherein the radicals R³ to R⁷ are as defined above,

L¹ to L³ are uncharged ligands are selected from the group consisting of CO, CO₂, R³NCO, R³R⁴C=CR⁵R⁶, R³C≡CR⁴, R³R⁴C=NR⁵, R³C≡N, R³OR⁴, R³SR⁴, NR³R⁴R⁵, PR³R⁴R⁵, AsR³R⁴R⁵, SbR³R⁴R⁵, wherein the radicals R³ to R⁵ are as defined above and m is 1 or 2.

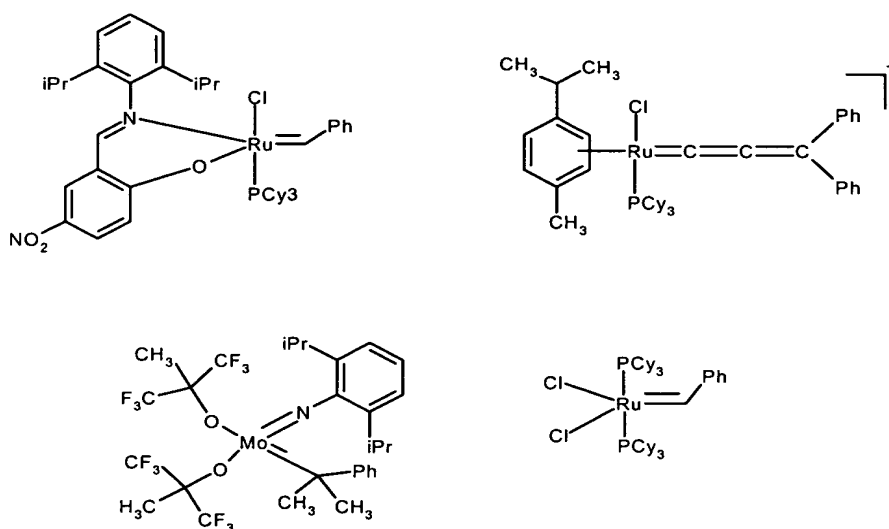
35. The process of Claim 34, wherein the catalysts or catalyst precursors used are compounds of the formula (III) and/or (IV), wherein L¹ and L² is PR³R⁴R⁵,

wherein R³ to R⁵ are as defined above.

36. The process of Claim 35, wherein R³ to R⁵ are selected from the group consisting of aryl and alkyl groups.

37. The process of Claim 36, wherein R³ to R⁵ are selected from the group consisting of secondary alkyl radicals and cycloalkyl radicals.

38. The process of Claim 35, wherein the catalysts used are the following compounds:



39. The process of Claim 32, wherein the ionic liquids used are selected from the group consisting of ammonium hexafluorophosphate, ammonium tetrafluoroborate, ammonium tosylate, ammonium hydrogen sulphate and salt mixtures comprising aluminium halides in combination with at least one quaternary ammonium halide and/or at least one quaternary phosphonium halide.

40. The process of Claim 34, wherein the ionic liquids used are selected from the group consisting of pyridinium hexafluorophosphate, pyridinium tetrafluoroborate, pyridinium hydrogen sulphate, 1-methyl-3-butylimidazolium hexafluorophosphate or combinations of aluminium chloride with 1-methyl-3-butyl-

imidazolium chloride, 1-methyl-3-ethylimidazolium chloride, N-butylpyridinium chloride and tetrabutylphosphonium halide.

41. The process of Claim 22, wherein the ionic liquids used are selected from the group consisting of combinations of aluminium halide with mixtures of quaternary ammonium halides, quaternary phosphonium halides, and mixtures of ammonium hexafluorophosphate, ammonium tetrafluoroborate, ammonium tosylate and ammonium hydrogen sulphate.

42. The process of Claim 22, wherein the reaction medium further comprises an additive selected from the group consisting of phosphorus compounds, amines, perfluorinated compounds, metal alkoxides and organic solvents, perfluorinated compounds, metal alkoxides and organic solvents.